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ENTOMOLOGICAL NEWS

VOL. LIII NOVEMBER, 1942 No 9

Studies on Sibling Callosamia angulifera (Lepidoptera: Saturnidae).

By C. BROOKE WORTH, Swarthmore College,
Swarthmore, Pennsylvania.

In June, 1941, a female *Callosamia angulifera* hatched from a "wild" cocoon that I had found during the previous winter. I placed the moth inside a screened porch, and at nine o'clock that night several males were fluttering outside the screen. A single male was allowed to enter and copulate with the female, so that the subsequent eggs which she laid in a cardboard box were all true siblings, the offspring of a s i n g l e father and mother. My ensuing studies investigated the variations which might be readily observed among sibling *C. angulifera* within an identical environment. It cannot be assumed fully that such variations represented genetic differences, for there were undoubtedly inequalities even within that confined environment. But the observed differences are at least suggestive of different genic combinations.

The eggs were laid over a period of four days. Hatching occupied an equal period of time, the last eggs laid being the last ones to hatch, showing that fertilization is a progressive process within the female. This is in accord with gross findings in the dissection of a newly-hatched moth. Here the egg "strings" show the best-formed eggs at the peripheral end of the "string" near its junction with the ovipositing organs, while the more central or inner end of the "string" exhibits eggs of less and less maturity, the last ones being so rudimentary that they probably have not time—at least in the non-feeding *Saturnidae*—to develop fully before the moth dies.

The caterpillars, therefore, varied from one another in age from the very beginning, a maximum difference of about one hundred hours obtaining between the extremes. This difference, at first quite noticeable, soon became less obvious, for caterpillars that had hatched on the same day quickly began to

show variations in size as well as in their times of ecdysis. Thus by the third instar it was impossible to sort out groups according to age. Thereafter, I regarded them all as a single colony of more or less uniform siblings.

I raised the larvae in mosquito-netting bags covering low branches of a tulip poplar tree at Princeton, New Jersey. During the latter stages of their growth they exhibited differences in size aside from the presumed sexual ones, i.e., the larger larvae varied quite perceptibly among themselves, as did also the smaller ones. There was also slight variation in the intensity of their colors.

But the first marked disparities were noted at the stage of cocoon-spinning. This phase occupied about two weeks. Allowing for the possible four-day difference in chronological age, one concludes that a variation of ten days in physiologic age had been established during the short larval period. This consisted of one day of variation for about ten days of larval life. Spinning occurred at random, regardless of larval size, so that the observed difference is physiologically and genetically valid.

At this time there were also several differences in spinning-technique. Most of the larvae tried to escape from the net, some actually succeeding in chewing or worming their way through its meshes. These fugitives crawled inward along the branch until they reached the main trunk of the tree and then descended to the ground. Those that failed to escape spun their cocoons in the folds of netting where it was gathered together and tied about the branch: this represented the farthest attainable distance from the feeding-grounds in the foliage at the end of the branch.

But about a quarter of the caterpillars spun cocoons in the leaves where they had spent their larval lives. Within this group there was also variation in spinning-behavior. Some merely drew two or more leaves together and spun cocoons without anchorage to the twig. Others began a "strap" which, however, proceeded only part way along a leaf's stem. The rest completed the "strap" so that its upper end embraced the

twig firmly, and in this group was found a high percentage of cocoons that utilized only a single curled leaf. The latter type was indistinguishable from the conventional cocoon of *C. promethea.*

One hundred and ten cocoons were gathered at last and placed together in a small screened cage that was open to the environment in all its faces. The cage was hung to a wire fence beneath the tulip poplar tree and allowed to remain there for the winter.

In May, 1942, I transferred the cage to my desk at Swarthmore, Pennsylvania. Here, under indoor conditions, I waited for further exhibitions of variation among the sibling *C. angulifera.*

Table I shows the order in which the cocoons hatched. It will be noted that in general males preceded females, at one early period (May 21) outnumbering the latter almost two to one. But later (after May 26) the females surpassed the males in absolute numbers.

This may indicate several qualities inherent in *C. angulifera* as a species (rather than from the sibling standpoint). Males being on the average smaller than females, their total requisite metabolic processes in attaining hatching-maturity will be calorrically less than that of their sisters. Thus a given quantity of heat during Spring days will further males' metamorphosis proportionately more than females'. Hence maturity will arrive first in the male population. This incident may well have survival value to the species, since the first females to hatch will thereby be assured of having potential mates already on the wing. The last females, hatching after the last males, may still mate with decrepit males on the point of death. This does not matter, since the male's responsibility ceases immediately after copulation, while the f e m a l e ' s is all the more enhanced. It is essential that females mate on the first evening after hatching, or at least not later than the second evening, for were *they* to copulate when almost exhausted by imaginal living, they could never succeed in laying their eggs in appropriate places—or even in laying them at all.

The relative smallness of males has, of course, an added advantage in survival of the species, for it enables them to fly longer distances with less consumption of fuel. This not only makes it possible for them to range widely in search of females, but may also add to their longevity—again contributing advantageously to the females' chances for being discovered and fertilized.

TABLE I

Hatching of Sibling *C. angulifera*—1942

Date	*Females*	*Males*
May 10		1
11		
12		
13	2	1
14	2	2
15	1	1
16		
17	2	1
18		5
19		
20	2	4
21	1	4
22	3	3
23	3	2
24	2	1
25	2	1
26	3	1
27	7	1
28	2	2
29	6	3
30	4	
31	3	
June 1		
2	1	
3		
4		
5		1
6	1	1
7		
8		
9		
10		1
11	2	
12	1	2
13	2	1
14		
15	1	
16	1	
17	1	
18	2	
19	2	
Totals	59	39

(To be continued.)

Note on the Genus Bertoniella (Orthoptera, Tettigoniidae, Agraeciinae)

By JAMES A. G. REHN, Curator of Insects, Academy of Natural Sciences of Philadelphia.

There has recently appeared in the "Memorias del Museo de Entre Rios" [1] the first part of a series of studies by Augusto A. Pirán, entitled "Contribucion al Conociemiento de los Tettigonioideos (Orthoptera: Tettigonioidea) de la Mesopotamia Argentina." In the second unit of the four making up this part there is described a "Nueva especie y nuevo género de Conocephalidae," to which the name *Guaranina* is given. The relationship of this new genus is said to be with *Xiphelimum* Caudell, a genus well known to the present author, and which is quite typically a member of the Conocephalinae or Conocephalidae, whichever value may be accorded that aggregation.

Unfortunately, as clearly shown by the very good figures and the relatively brief description, the insect described as *Guaranina daguerrei* is not a member of the same subfamily or family as *Xiphelimum,* but is instead referable to that assemblage called the Agraeciinae or Agraeciidae, whichever value may be preferred.

It is to be regretted that the author of this Argentine paper apparently has failed to consult at least some of the literature dealing with the Orthoptera of the region of the Paraná River. The insect to which he has applied the new generic name *Guaranina* was described and figured in 1911 by the present author as *Bertoniella agraecioides,* new genus and species. The type of the latter came from Puerto Bertoni, Paraguay, a locality not far removed from Posadas, Misiones, Argentina, from which place *Guaranina* was described. With the type male and the allotypic and four other females of *B. agraecioides* now before me, there can be no question as to the identity of Pirán's genus and species.

The synonymy would be as follows:

[1] Zoologia No. 17, pp. 3-8, pls. I-III. Paraná, Argentina, 1942.

BERTONIELLA Rehn.

1911. *Bertoniella* Rehn, Entom. News, xxii, p. 255.

1942. *Guaranina* Pirán, Mem. Mus. Entre Rios, Zool. No. 17, p. 4.

BERTONIELLA AGRAECIOIDES Rehn.

1911. *Bertoniella agraecioides* Rehn, Entom. News, xxii, p. 255, figs. 3-5.

[♂ (type), ♀ ; Puerto Bertoni, Paraguay.]

1942. *Guaranina daguerrei* Pirán, Mem. Mus. Entre Rios, Zool. No. 17, p. 5, pl. 1, fig. 3, pl. II, figs. 4-6. [♂, ♀ (type); La Picada, near Posadas, Misiones, Argentina.]

The range of the species is more extensive than published literature would indicate, as it extends northeastward into the drainage of some of the head streams of the Paraná. Aside from Puerto Bertoni, Paraguay, the type locality of *agraecioides,* the following localities are represented in the series before me:

Villa Lutecia, vicinity of San Ignacio, Misiones, Argentina; IV, 1910; (E. R. Wagner); 1 ♀ ; [Hebard Cln.]. Piracicaba, State of São Paulo, Brazil; 3 ♀ ; [Hebard Cln.].

There is an appreciable amount of variation in general size in this species, and also in the length of the alar appendages.

OBITUARY

DR. ANTON VON SCHULTHESS-SCHINDLER, president of the Third International Entomological Congress at Zurich in 1925, died November 7, 1941, acording to a notice in the Mittheilungen of the Swiss Entomological Society (vol. 18, pp. 398-399).

Additions to the Insects in the U. S. National Museum. The most important accession in insects [during the fiscal year ended June 30, 1941] was the Nevermann collection of Costa Rican Coleoptera, comprising about 33,000 specimens and including much type material. Other important entomological material came in many miscellaneous lots, the largest beng 64,000 insect specimens transferred from the Bureau of Entomology and Plant Quarantine.

A collection of nearly 3000 beetles from Panama was donated by Assistant Curator Richard E. Blackwelder, who collected them several years ago.—Annual Rept. Smithsonian Inst., 1941, p. 20, 1942.

Heavy Infestation of Tent Caterpillars in Chester County, Pennsylvania (Lepidoptera: Lasiocampidae).

By Joseph L. Williams, Lincoln University, Pa.

During the spring of 1942 the infestation of tent caterpillars (*Malacosoma americana* Fabr.) was about the heaviest of any season for several years in Chester County. In both Chester and Delaware Counties, on the highway to Philadelphia, not one wild cherry tree escaped being infested. Apple trees were more heavily infested than usual, but their infestation is never as heavy as that of the wild cherry during any season. Wild cherry is more heavily attacked because the caterpillars prefer this plant to any other. Experiments have been made which show that impregnated females can be induced to lay their eggs around a wire of a suitable diameter, if twigs of trees are not present. If, however, twigs of a suitable diameter of several trees are made available to such females, cherry in most cases is selected. Even virgin females prefer wild cherry, but their effort to lay is in vain. Fertilization is absolutely necessary for normal egg-laying. This egg-laying behavior is true for all Lepidoptera, except a few whose eggs have been reported to hatch parthenogenetically. Adult females selecting wild cherry twigs on which to lay their eggs explain why these trees are more heavily infested than apple.

The author has been trapping insects by means of a light trap since 1936 and during this period, except this season, tent caterpillar moths were never caught in large numbers. This season, however, the light trap was crowded with the moths. The males were much more numerous than the females, yet the latter were present in fairly large numbers each night throughout the flying season. Several nests of caterpillars were burned from a few apple trees on the author's lawn, but many escaped being harmed and climbed the trees again and again to build new nests. After burning the newly formed nests several times, the caterpillars were finally destroyed.

About the middle of June several wild cherry trees in the vicinity of Lincoln University were examined. From ten to twenty or more egg-rings were found on some small trees. This

gives some indication of the number of impregnated females on wing during the season. This also gives an indication, if this year's conditions prevail, of next year's crop, since about 180 eggs are present in each egg-mass. Fortunately, females of *M. americana* mate and lay only once before death, which is not true for all Lepidoptera. Unfortunately, however, nearly all females on wing are impregnated, which enables them to lay normally. This statement is substantiated by the fact that dissections of most female Lepidoptera caught at the light trap have spermatophores in their bursae. This means, therefore, that they have mated and the number of spermatophores present indicates the number of pairings. Only one spermatophore is ever found in the bursa copulatrix of *M. americana.*

The work of Turner further substantiates the statement on the fertility of flying females. Our only hope, therefore, must depend on a fly (Diptera), which parasitises the caterpillar if the number is to be normal next year. Perhaps this fly and other parasites of the tent caterpillar were fewer this year, which may explain the outbreak.

REFERENCES.

TURNER, W. B. 1918. Female Lepidoptera at light traps. Jour Agri. Research, 14 (3) 135-149.

WILLIAMS, J. L. 1939. The mating and egg-laying of Malacosoma americana. Ent. News, 50 (2), 45-50, (3), 69-72.

ID. 1940. The anatomy of the internal geneitalia and the mating behavior of some Lasiocampid moths. J. Morp., 67 (3) 411-433, 2 pls.

The Insects in the American Museum of Natural History, New York City.

We received through 201 gifts approximately 38,000 specimens. Our study collections now contain approximately 1,735,000 specimens, of which roughly 398,000 are moths or butterflies; 346,000 are beetles; 288,000 are flies; 242,500 are ants, bees or wasps, and 232,500 are spiders and their relatives. Owing to the danger of bombing in New York City we moved our thousands of type specimens to the safer place provided by the Museum.—73rd Ann. Rept. Amer. Mus. Nat. Hist. for 1941, p. 13.

Mating Flights of Isonychia May-flies (Ephemeroptera).

By HERMAN G. COOKE, University of Pennsylvania, Philadelphia.

Relatively few accurate observations have been made on the mating flights of mayflies. Morgan writes, "Actual mating has been observed but a few times. The most satisfactory observation was made (May, 1911) upon a swarm of *Baetis*. Murphy's[2] observations on the mating behavior of *Baetis posticatus* supported Morgan's statements. In a more recent account of the order of mayflies, Needham and associates[3] remark, "And for many mayflies the swarming habits are quite unknown."

In a previous paper[4] the writer has recorded an observation on the mating flights of *Stenonema vicarium*. Opportunity has been afforded to extend this observation to species of *Isonychia*.

The temperatures at which eggs of mayflies hatched have been recorded by writers in several scattered papers. However, data on the temperature for nymphal emergence and that for adult behavior in nature have been greatly restricted. The most available information on the latter two activities may be found in the work by Clemens and by Murphy.

In an ecological study of mayflies Clemens[5] found that temperature had a very marked effect on the length of subimaginal period. Murphy[2] recorded a monthly average of temperature in her study of *Baetis posticatus*. From May to October inclusive, she found that the average temperature for

[1] Morgan, Ann. H. 1913. Contribution to the Biology of Mayflies. Ann. Soc. Amer. 6: p. 392.

[2] Murphy, Helen. 1922. Notes on the Biology of Mayflies Genus *Baetis* Bull. Lloyd Library Ent. Ser. 2.

[3] Needham, J. G., Traver, Jay R. and Hsu, Yin-Chi. 1935. The Biology of the Mayflies, p. 10.

[4] Cooke, Herman G. Jan., 1940. Observations on Mating Flights of Mayflies *Stenonema vicarium* Ent. News 51.

[5] Clemens, W. A. 1917. An Ecological Study of the Mayfly Chirotenetes. University of Toronto Studies Biol. Ser. 17.

nymphal emergence (of brood four) was 62.2° F., for each month.

The writer also has observed that temperature is quite a factor as regards the behavior of mayflies. He has been able to secure the temperature and date of nymphal emergence and of adult behavior in nature as here noted. All temperatures were counter-checked by a thermometer employed on date of observations. It was found that the nymphs failed to emerge from the water as sub-imagoes when the temperature registered below 65° F. No doubt, the chief difference between the former and latter figures may be attributed to difference in species or environmental conditions or probably both.

The present study began on August 24, 1940, when a lone male was observed descending over the banks of Darby Creek from a large company of imagoes which swarmed high up among the branches of trees beneath a mid-day sun. The location was almost two miles up stream from Oakview, Pennsylvania. Neither copulation nor the movements that usually characterize actual mating took place; nevertheless, the incident occuring at a height of forty or fifty feet served not only as a clue toward further investigations, but also as a confirmation of a report by Needham[3]. In a paragraph on the swarming of *Callibaetis* that author writes, "Other mayflies fly at a higher altitude in swarming; some so high as to be observed with difficulty from the ground."

At 1:30 p. m., on the above date the atmospheric pressure registered 30.23 inches while the temperature was 69° F.[6]

The summer of the following year (1941) was uneventful in this field until September 26 and 27. At 3:30 p. m., both days, a small company of *Isonychia christina* (tentative identification of species) was seen rising and falling in deep rhythmic undulations over an evaporated pond-bed twenty yards from the west bank of the creek. The scene of this flight was approximately one hundred yards up stream from the location

[6] Records of atmospheric pressure and temperature were obtained from the Weather Bureau at Philadelphia, Pa. The times given are in Eastern War Time, one hour earlier than Eastern Standard Time.

of the male observed in 1940. At times the individuals soared to a height of about fifty feet while at frequent intervals they descended to within five feet of the ground. When the lower level was reached they quickly mounted upward as if the decended distance had been plotted by measurement. The vibratory body motion so effectively displayed by these insects during flight was more highly perfected by the males than by the females.

On September 26, 1941, at 1:30 p. m., the atmospheric pressure was 30 inches and at 4 P. M. the temperature was 78° F. The following day, at the same hours, the atmospheric pressure was 30.21 inches while the temperature fell to 73° F. The weather reports for the three above mentioned dates, suggest a fairly constant range of atmospheric pressure and temperature for the flights of *Isonychia*.

It was of particular interest to note a female entering the group of males attempting, in her sluggish manner, to participate in the rhythmic performance. Up to this point her role had been negligible, but she was soon spotted and attacked by a male as if he had been watchfully awaiting her arrival. The pair remained united during their flight for a distance of nearly thirty yards and then suddenly separated and vanished among the trees. Two other females passed unmolested beneath the swarm of males and continued on their journey. Shortly after this, at intervals of about ten minutes, two additional couples were seen in copulation. Each couple showed a tendency to be borne slightly downward as it proceeded along its course. Otherwise, copulation was conducted in a manner similar to that observed for *Stenonema vicarium*.

One of the most striking features exhibited during these flights was the trend displayed toward net shyness, (i.e., from the swinging of an insect net), a tendency probably carried over from the nymphal stage, as nymphs of this species are among the most wary and are difficult to capture. When the swarm was continuously disturbed it either withdrew to a more distant region, or its members became scattered and disappeared. However, after a few minutes interval they usually returned

to resume their performance in increasing numbers and with renewed vigor. Needham[3] also reported similar scattering in the genus *Callibaetis* that he observed: "——— suddenly vanishing ghostlike from view."

In order to capture *Isonychia* imagoes, it was necessary to lie in wait in the grass beneath the swarm until descending members had reached a lower level. Normally, these flights remained in progress for about thirty-five minutes. During prolonged interference, by the collector, the duration could not be accurately estimated. However, in either case, activity ceased long before sun-down.

The writer wishes to express his gratitude and appreciation to Dr. P. P. Calvert for his stimulating interest freely shown throughout this investigation, and to Dr. H. T. Spieth for having aided in the classification of this as well as several other species of mayflies. Thanks are due also to Dr. D. H. Wenrich, Dr R. G. Schmieder and Mr. E. T. Cresson, Jr., for helpful suggestions.

The Carry-over of Jungle Fever Virus. Continued investigation of jungle yellow fever in Colombia brought added evidence that, in certain areas at least, a *Haemagogus* mosquito is the chief villain in the tragedy. One of the puzzling aspects of this problem has been the complete disappearance of this mosquito at certain periods, especially during the dry season, while at the same time the disease has continued among both animals and men. This problem was resolved by the discovery that *Haemagogus* is characteristically an inhabitant of the tree tops and may be found there when it is absent in catches made at ground level. The investigators were forced to develop techniques new to yellow fever work, and as one of them expressed it, it became necessary "to associate with the monkeys in the interlacing branches high above the jungle floor." With this knowledge available it was possible to capture haemagogus mosquitoes throughout the entire dry season of 1941, and the yellow fever virus was found repeatedly in the mosquitoes caught in the tree tops.—Rockefeller Foundation, Annual Rept. 1941, p. 15.

An Apparatus for Obtaining Interval Collections of Insects[1]

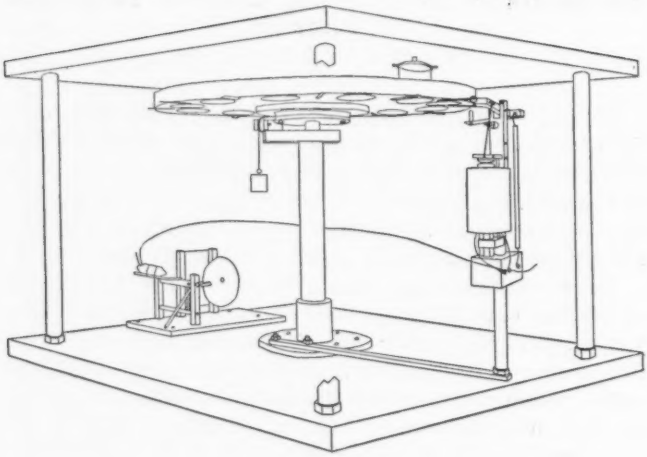
By WILLIAM R. HORSFALL and ALLEN V. TULLER, University of Arkansas.

Interval collections are often desired in connection with faunal studies of insects, and in order to get reliable results, periodic attention of an operator or some mechanical contrivance is necessary. In instances such as night collecting, continued, regular attention of an operator is often out of the question, and a dependable, automatic device is a desirable substitute.

The automatic change feature herein reported has proved satisfactory in conjunction with a light trap of a modified New Jersey style. Night after night for three months in each of two summers (1940 and 1941) this device operated reliably with a minimum of attention in connection with observations on flight habits of rice-field mosquitos at the University of Arkansas Rice Branch Experiment Station. It might prove equally efficient when used with any type of stationary trap of such a nature that the insects are received in bottles or jars, provided a constant source of electricity is available.

The Light Trap. The New Jersey light trap used in this connection was similar to that reported by Mulhern (1934) except in minor details. It consists exteriorly of a vertical cylinder with a conical cap housing a 40 W. frosted electric globe, an eight-inch electric fan, and a funnel of screen wire. The light bulb is exposed between the cap and cylinder and may shine in all horizontal directions. The fan is placed below the light and the blast is directed downward into the screen funnel below. In the regular trap, a killing jar is attached to the apex of the funnel. In this instance, it is attached to a hole in the top of the box housing the automatic change feature. Another small internal change involved the addition of a screen cone between the fan blades and the light which prevents insects caught in the down draft from lodging in the fan motor or from

[1] Research Paper No. 744, Journal Series, University of Arkansas. Approved for publication by the Director of the Arkansas Agricultural Experiment Station.



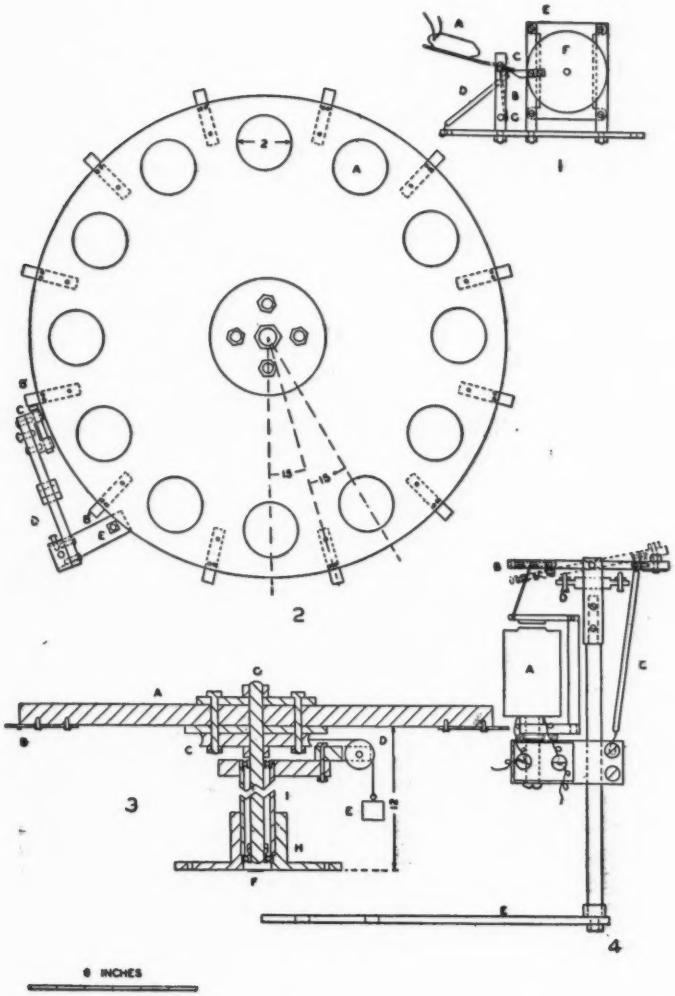
(Fig. A)

being mangled in the whirling blades.

The Automatic Feature. The device for changing the collecting jars is mounted in a box (Fig. A) composed of a top and a bottom made of five-ply wood joined to one another by four steel corner posts 16 inches long and threaded at both ends. Nuts placed on each side of the top and bottom boards enable the operator to make possible any small adjustments of leveling. Both top and bottom are covered with several coats of spar varnish as a preventive against warping or checking. The sides of the box are of sheet metal attached so as to prevent injury to the enclosed mechanism by splashing or blowing rain. One side is easily removable as a means of facilitating changes of collecting jars or adjusting the machine. The box is rectangular in top view and measures 15 inches by 20 inches.

The mechanism proper consists of a turntable (Figs. 2 and 3) to which twelve collecting jars are attached, a tripping device (Figs. 2 and 4) and a timer (Fig. 1).

The turntable (Fig. 2) is composed of a disc of plywood on top of a supporting column that is firmly bolted to the floor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of the rectangular box. The disc is made of five-ply wood in which 12 holes (2A) two inches in diameter are drilled near the margin at 30° intervals. At the same intervals and centered between the holes, are 12 flat metal strips (2B[1]) ½ inch wide and extending ⅝ inch out from the underside of the disc. Each metal strip is firmly held in place by three wood screws ½ inch long. Metal screw caps for the attachment of 16-ounce collecting jars are cut with holes to fit those in the disc and are fastened by ¼-inch screws to the underside of the disc.

At its center, the turntable is provided with two large metal washers on both top and bottom (Fig. 3). These two washers and thin wooden pulley (3C) are bolted securely to the center of the disc. The whole disc (3A) is attached to its supporting shaft by a nut below and above the disc on the threaded shaft (3G). The disc is held upright and suspended free on two ball bearings (3F) at either end of a hollow column (3I). The bottom bearing supports the thrust and the upper one acts to align the shaft. The supporting column (3I) is threaded into a floor flange (3H) which in turn is bolted to the bottom of the box. This form of support allows the whole turntable to be freely movable by means of a very slight tension.

In operation, a continuous tension is exerted on the turntable by means of a weight (Fig. 3E). This weight is fastened over a free pulley (3D) to the pulley (3C) attached to disc (3A).

Figure 4 is a diagram of the trip-and-check device that allows the tension weight to turn the disc or that prevents the turning as the case may be. Essentially this device is composed of an electromagnet (4A) below a horizontal trip-and-check arm (figs. 2D and 4B). The whole is supported by means of a vertical shaft from a horizontal base plate (4E) which is bolted to the floor of the box. The trip-and-check arm (4B) is pivoted at the center and is free to move by teetering action within limits determined by set screws on crossarm (4D).

The whole is activated by an automatic switch (Fig. 1) by means of which an electric circuit is made or broken at a pre-

determined interval. The mechanism in use is designed to operate at intervals of one hour by means of a self-starting 1 R.P.H. electric clock (1E) operating on 110 volts A. C. A disc (1F) is attached to the central shaft of the clock. A pointed, radial projection (1B) serves as the means of shifting the position of the mercury switch (1A) so as to complete the circuit through the electromagnet on the trip-and-check device. The mercury switch (1A) lies at such an angle on a hinged bar that the mercury is free of the contacts. When the radial arm (1B) strikes the projection (1C) on the hinge of the mercury switch, the switch is depressed on the contact end, and the circuit is closed. After the radial arm passes the point, spring (1D) snaps the switch back to its normal position and opens the circuit. Arm (1G) on the switch hinge prevents spring (1D) from turning the switch over by striking against a horizontal rod supported between the two posts holding the switch hinge.

In operation, 12 jars containing small bags of potassium cyanide are fastened to the screw caps on the turntable. (It is necessary that all be attached in order to balance the turntable as an aid to uniform turning). The tripping mechanism is released by hand and the turntable is rotated until the tension weight (3E) is in the position shown. Jar Number 1 should be in place beneath the hole leading down from the trap above. Disc (1F) of the timing device is then turned so that the radial trip (1B) is just above the projection (1C). The current is then turned on and the mechanism is set to release at the end of an hour and to operate continuously at hourly intervals until all twelve jars have passed beneath the trap and have been exposed one hour each.

While the circuit is broken through the electromagnet (4A) the trip-and-check arm is in the position shown in Figure 2 with the bumper rod (2C) against the steel plate ($2B^1$). When the current is completed through the electromagnet, the end on which the bumper rod is located is pulled downward by the magnet and the steel plate ($2B^1$) passes over the rod. After the turntable moves only a short distance (about $\frac{3}{8}$ inch), plate ($2B^2$) is caught by the upright projection (2E) on the

uptilted end of the trip-and-check arm, and it holds the bottle below the trap until the circuit is broken at the timer. This interval is about 1½ minutes. When the magnet is released, the arm is returned to the normal position by the spring (4C). The tension weight, then causes the turntable to rotate until the next succeeding horizontal plate strikes the bumper rod (2C).

Two accessory features of this mechanism insure that all insects in a given period pass into the proper jar. The first of these, a screen tube extending below the hole in the top of the box to which the trap is attached, conveys the insects straight down into the bottle below. The other is a temporary closing device for the jars after they have passed beneath the trap. This consists of a weighted cloth flap suspended from the top of the box and serves to confine all insects for the hour after passing under the trap. By that time, the cyanide will have stunned even the most hardy sufficiently to retain them in the proper collecting jar.

The design of this mechanism lends itself to a variety of time intervals depending on the revolutions of the clock that is used and on the spacing and number of radial tripping arms on the timer disc. In combination with an automatic switch for starting and stopping the mechanism, the possible combinations of intervals are further extended.

Other devices which are adapted to similar purposes are those of Williams (1935) and Hutchins (1940).

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Rearing Technique for Corrodentia[1]

By KATHRYN M. SOMMERMAN [2] University of Illinois, Urbana, Illinois.

Using the various methods described, the following species of Corrodentia were successfully reared in the laboratory: Trogiidae: *Liposcelis divinatorius* (Müll.), *L. niger* (Banks); Psocidae: *Pseudopsocus amabilis* (Walsh) (*Pseudopsocus* Chapman 1930); Caeciliidae: *Caecilius manteri* Sommerman MS., *Lachesilla nubilis* (Aaron), *L. pedicularia* (Linné), *L. forcepeta* var. *major* Chapman, *Ectopsocus pumilis* (Banks), *E. californicus* (Banks) and *Caecilius aurantiacus* Hagen. Incidentally all but the last two species were taken from dried corn stalks in the fields.

1. A fairly successful method of raising colonies was devised, but the degree of success varied with the species. It entailed the use of a small cylinder 92 mm. long by 36 mm. in diameter (Fig. 1-A). A cork containing a hole, for the insertion of a glass tube 75 mm. long by 10 mm. in diameter, and two notches in the sides, closed the top. Cut up corn sheaths were put in the cylinder and a moist cotton plug was pushed down into the 10 mm. tube. Small pieces of cotton were used to close the notches in the cork, which served as an air escape as the water soaked through the large cotton plug that was moistened once a day. A cylinder of this kind usually accommodated one generation of psocids. The particular advantage offered by this device lay in the convenience with which new cultures could be transferred. The moist plug could be removed from the tube and the latter pushed into the cork of a freshly fixed cylinder. Within a few hours enough psocids would have passed into the new cylinder so that the old one could be withdrawn, and a new tube, containing a moist plug,

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[2] I wish to express my appreciation of the suggestions given by Professors C. L. Metcalf and W. V. Balduf during my study of the bionomics of some corn (maize) stalk-infesting Corrodentia.

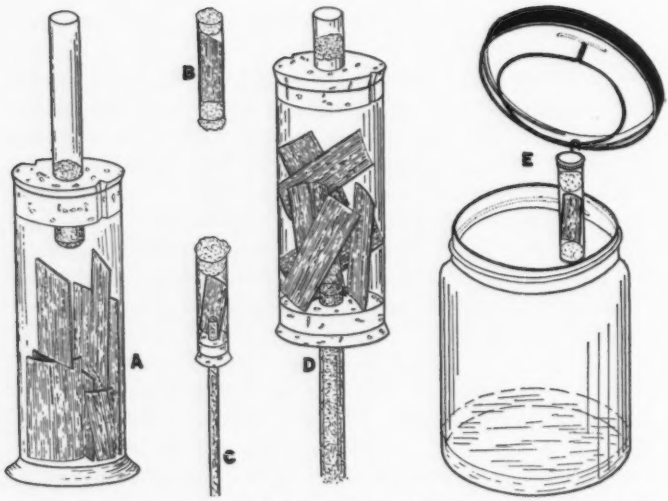

Fig. 1. A, Method 1; B, Method 2; C, Method 3; D, Method 4; E, Method 5.

put into the cork of the second. Usually the cylinders were placed in a horizontal position during the transfer, or a piece of used carbon paper was wrapped around the old culture while the new was subjected to the light. However, in transferring *Ectopsocus pumilis,* either the phototropic method was used or the cylinders were left, one above the other, utilizing the marked negative geotropism exhibited by this species.

2. The most successful individual rearing device (Fig. 1-B) consisted of a glass tube 33 mm. long by 8 mm. in diameter. Cotton plugs were inserted at each end and touched the piece of corn sheath that fitted snugly between them. A notch was cut at the edge of the sheath, or a corner cut off, thus giving the psocid access to both sides. The top plug was saturated with water four times a day at intervals of five hours. If the corn became too mouldy, or if no mould appeared, a fresh piece of corn sheath was inserted. Usually at least three changes were necessary during nymphal development. This device has been tried for some other pine bark inhabiting species but was not

successful.

3. Another fairly successful method was tried. Individual glass tubes (Fig. 1-C) about twice the size of those used in Method 2 were equipped with a cork in the bottom containing a 2 mm. tube 10 cm. long, filled with cotton to serve as a wick, and a cotton plug in the top. These were placed in test tube racks, with the capillary tubes extending through the holes of the rack to a pan of water below. This made it possible to omit the constant watering. Unfortunately if the wick touched the corn, it became too mouldy and the insects would die.

4. This last method was employed on a much larger scale for colonies (Fig. 1-D). Cylinders about the size of those described in method 1 were used, with a cork in the bottom containing an 8 mm. tube 10 cm. long. A dry cotton plug was substituted for the moist one used in Method 1. These tubes were likewise placed in racks like those of Method 3. When the capillary tube was pushed up into the cylinder above the level of the food this method proved very satisfactory for cultures of *Liposcelis divinatorius* and *L. niger*.

5. Small tubes such as those described in Method 2 with pieces of wire around the top prolonged into a hook, were hung to a circle of wire attached through the cardboard of a screw top jar (Fig. 1-E). The jars, filled to a depth of one-fourth inch with various salt solutions to keep the humidity constant, [Chapman (1)] were kept at 70° F. in a constant temperature oven, but the mortality was extremely high; so this method was abandoned.

6. Another method tried, but not adapted to these species, was that described by Rosewall (2).

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Current Entomological Literature

COMPILED BY THE EDITORIAL STAFF.

Under the above head it is intended to note papers received at the Academy of Natural Sciences of Philadelphia pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

This list gives references of the current or preceding year unless otherwise noted. All continued papers, with few exceptions, are recorded only at their first installment.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. References to papers containing new forms or names not so stated in titles are followed by (*); if containing keys are followed by (k); papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

The figures within brackets [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of Entomological News for 10c. The number of, or annual volume, and in some cases the part, heft, &c., the latter within ( ) follows; then the pagination follows the colon :

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The Third Part of Mosquitoes of the Ethiopian Region, **Dr. F. W. Edwards'** Culicine Adults and Pupae, printed by order of the Trustees of the British Museum (Natural History) 1941, issued Jan. 24, 1941, has been received recently. Its author died Nov. 15, 1940, as the volume was about to go to press. It consists of viii, 499 pages, 183 text-figures and three colored plates of, chiefly thoraces, of adults. The fourth section of this volume deals with the zoogeography of Ethiopian mosquitoes, pp. 448-485.

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